GNSS and Elevation Certificates

North Carolina Geodetic Survey

North Carolina Floodplain Mapping Program

North Carolina Floodplain Mapping Program

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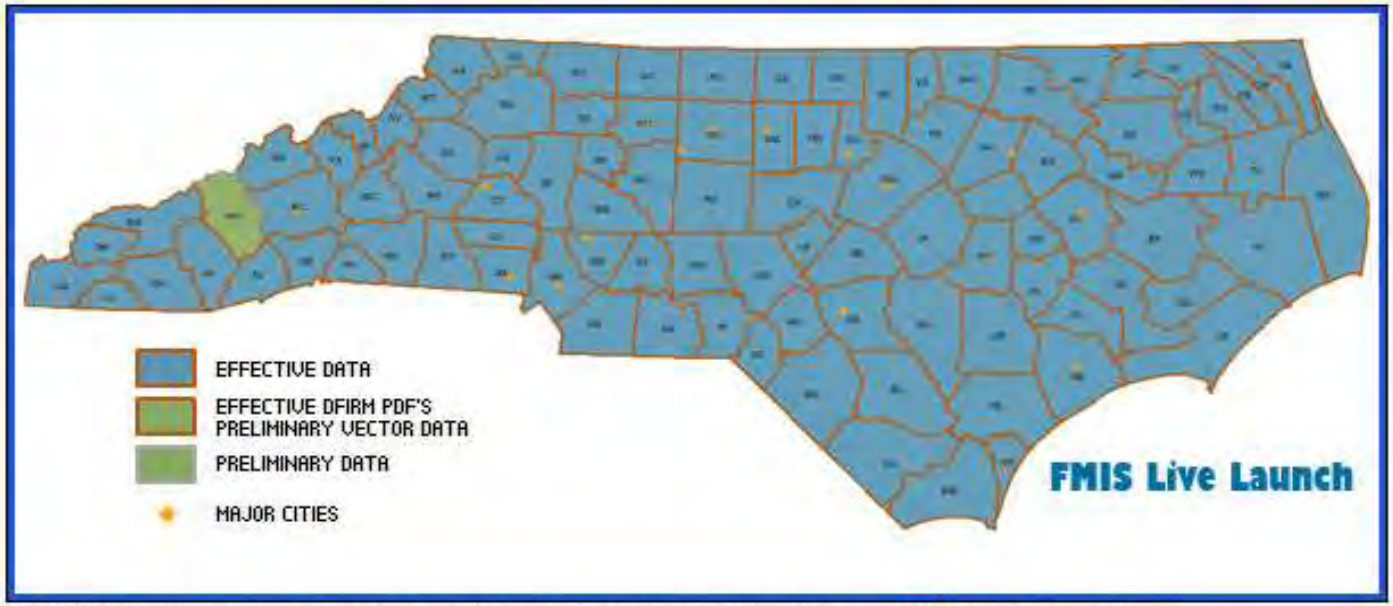
- Links
- Contact
- Flood Warning Program
- NCFMP Program Information
- 2008 NFIP Quick Guide
- CFM Home Study Course

FLOODPLAIN MAPPING INFORMATION SYSTEM [FMIS]



Click the image above to be redirected to the FMIS site. Data Download

This website is a free service provided by the State of North Carolina. The latest information on the Floodplain Mapping program is provided here. Learn about the State's partners in this project.

NEWS

New CLOMR Procedure for all Cases Effective October 1, 2010 - Endangered Species Act
August 23, 2010

www.ncfloodmaps.com/

LOCATION

NC Floodplain Mapping Program
Claude T. Bowers Bldg.
4105 Reedy Creek Rd
Raleigh, NC 27607

Phone: 919-715-5711

Key elements of the new maps

Base

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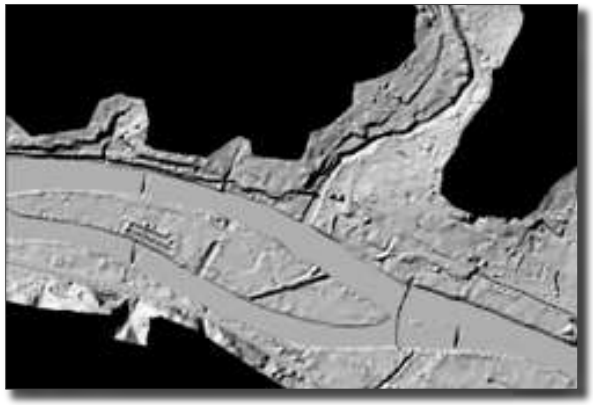
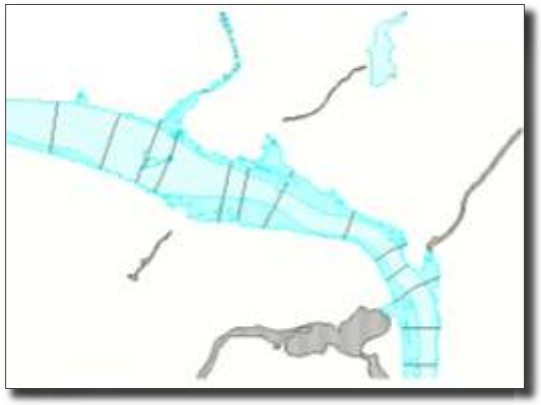


Topography

+

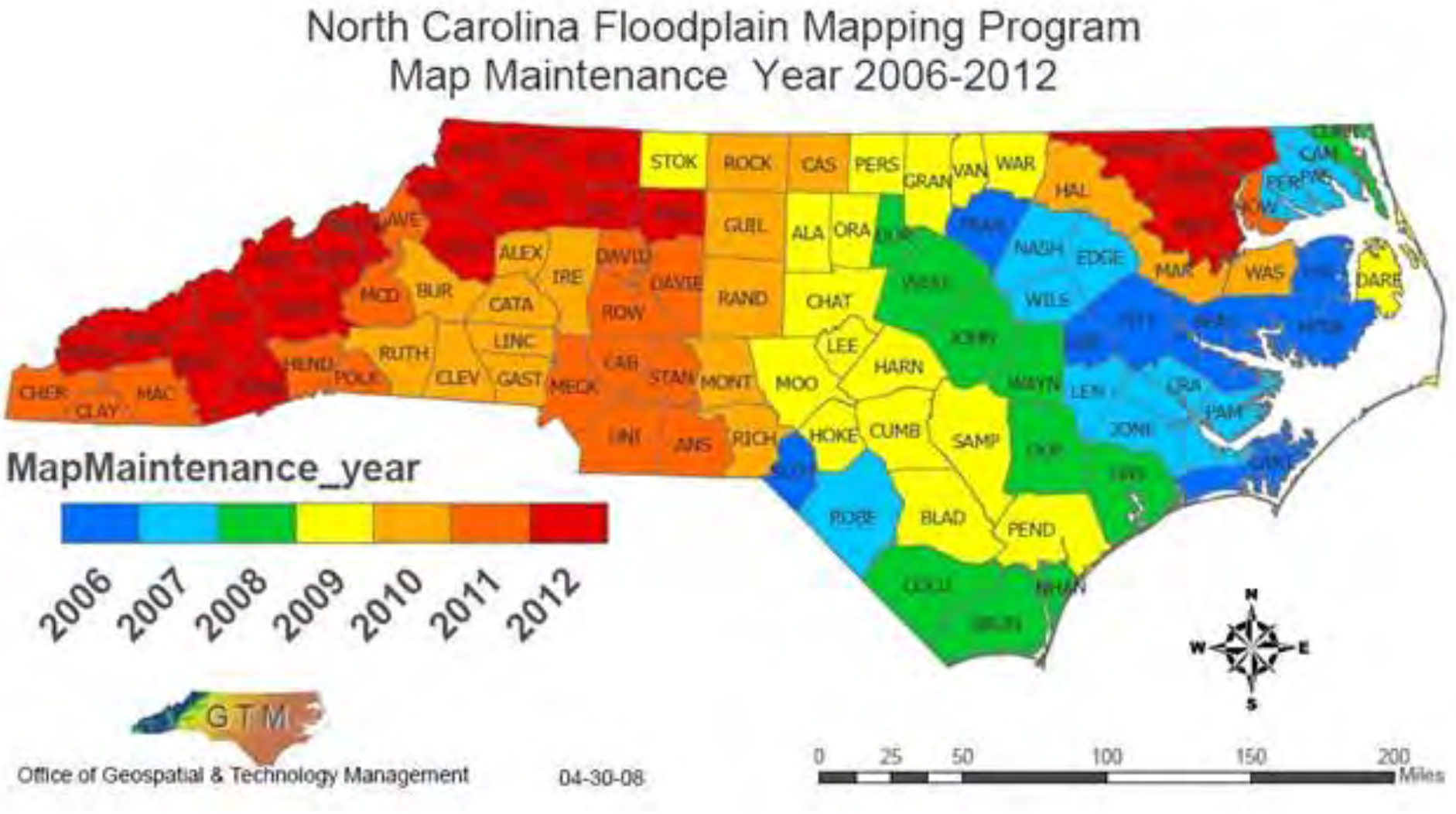


Flood Data

=

Digital FIRM

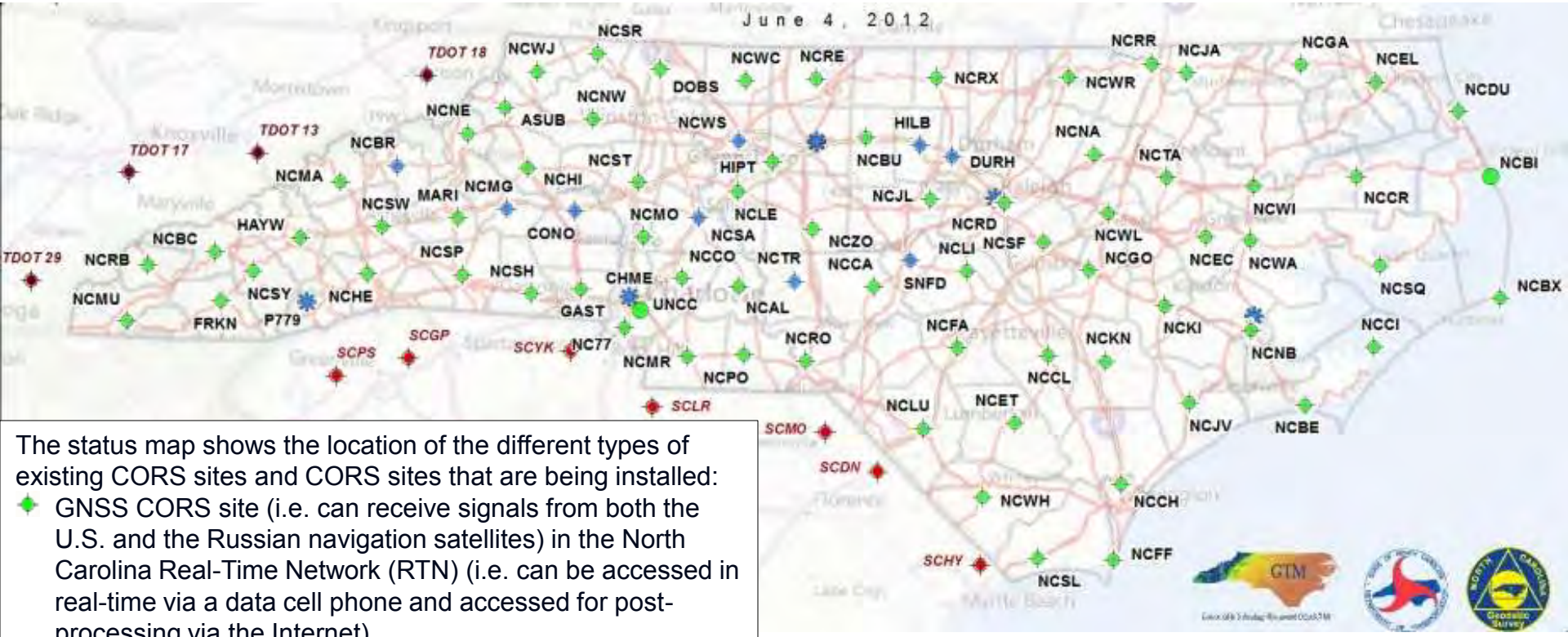
DFIRM map maintenance



www.ncfloodmaps.com/pubdocs/issue_papers/ip70_ncfmp_base_data_review_procedures.pdf

www.ncfloodmaps.com/pubdocs/issue_papers/ip24_final_nc_map_maintenance.pdf

Operational & proposed CORS



The status map shows the location of the different types of existing CORS sites and CORS sites that are being installed:

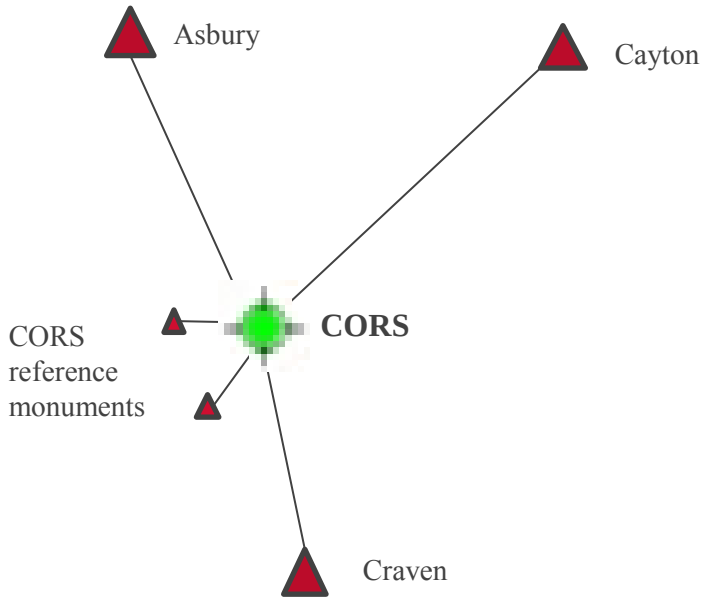
- GNSS CORS site (i.e. can receive signals from both the U.S. and the Russian navigation satellites) in the North Carolina Real-Time Network (RTN) (i.e. can be accessed in real-time via a data cell phone and accessed for post-processing via the Internet)
- CORS site (i.e. can receive signals from only the U.S. navigation satellites) in the NC RTN
- CORS site not in the NC RTN (i.e. cannot be accessed in real-time, but can be accessed for post-processing via the Internet)
- GNSS CORS site that is being installed and will be incorporated into the NC RTN
- SC CORS
- TN CORS

The status map also shows the coverage area of the NC RTN (depicted by blue shading), which has achieved statewide coverage.

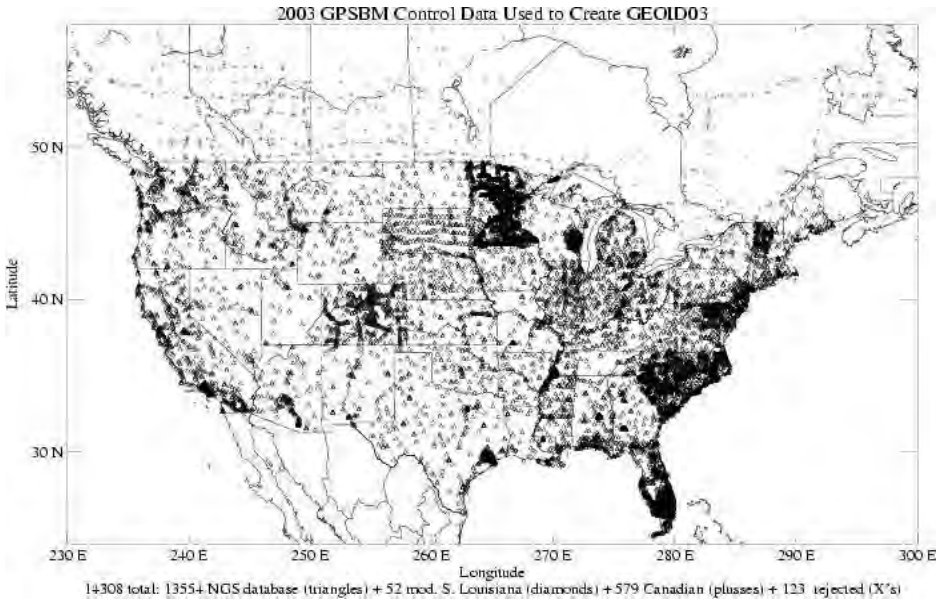
http://portal.ncdenr.org/web/lr/geodetic/maps/cors

CORS administration

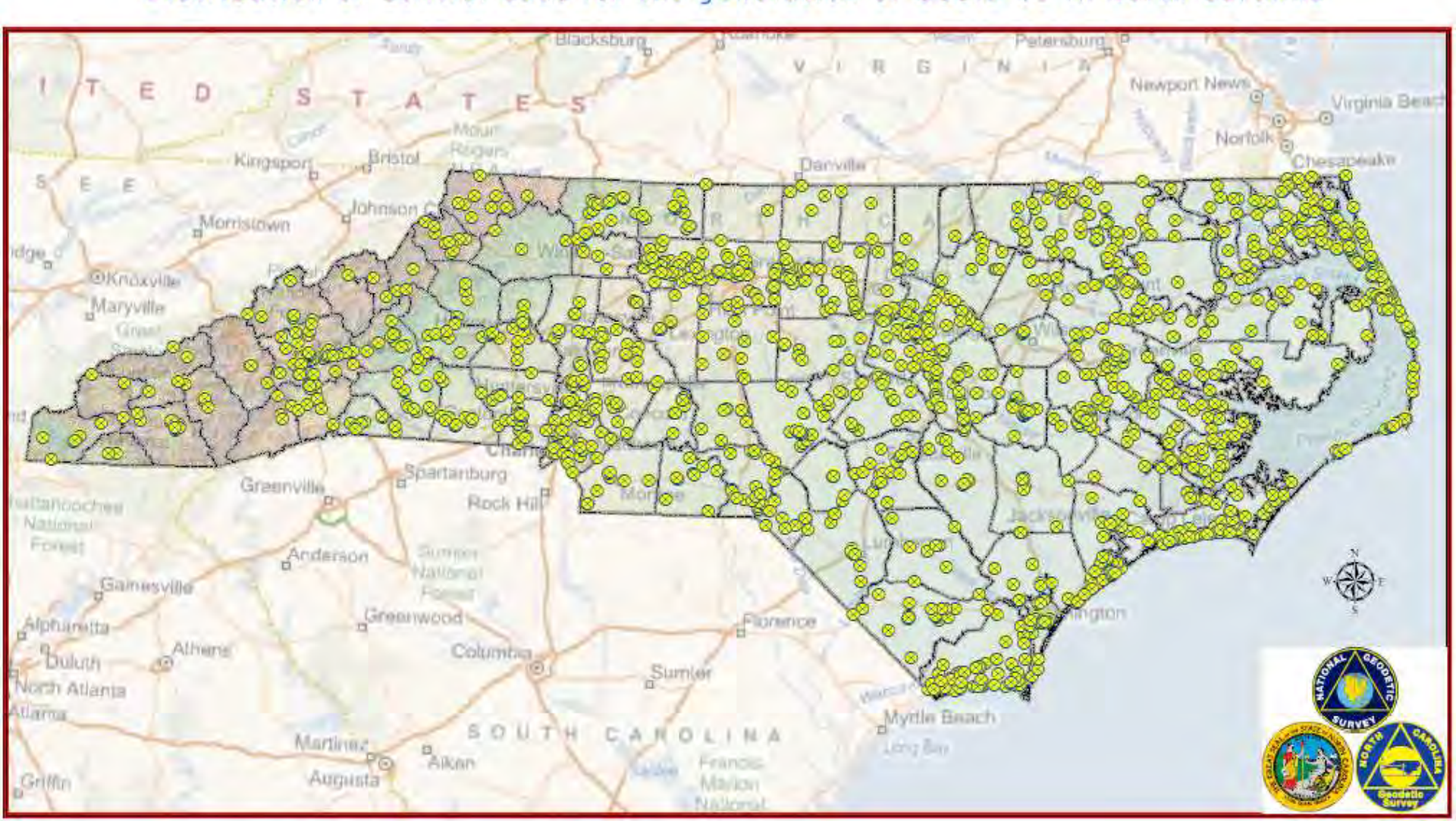
- **Connection to the NSRS**
  - Recommend local static surveys be performed to connect RTN CORS with local NSRS passive stations
  - NCGS uses NGS-58 surveys to connect the CORS to the NSRS
    - CORS
    - Three (3) HARN monuments
    - Two (2) local CORS reference monuments



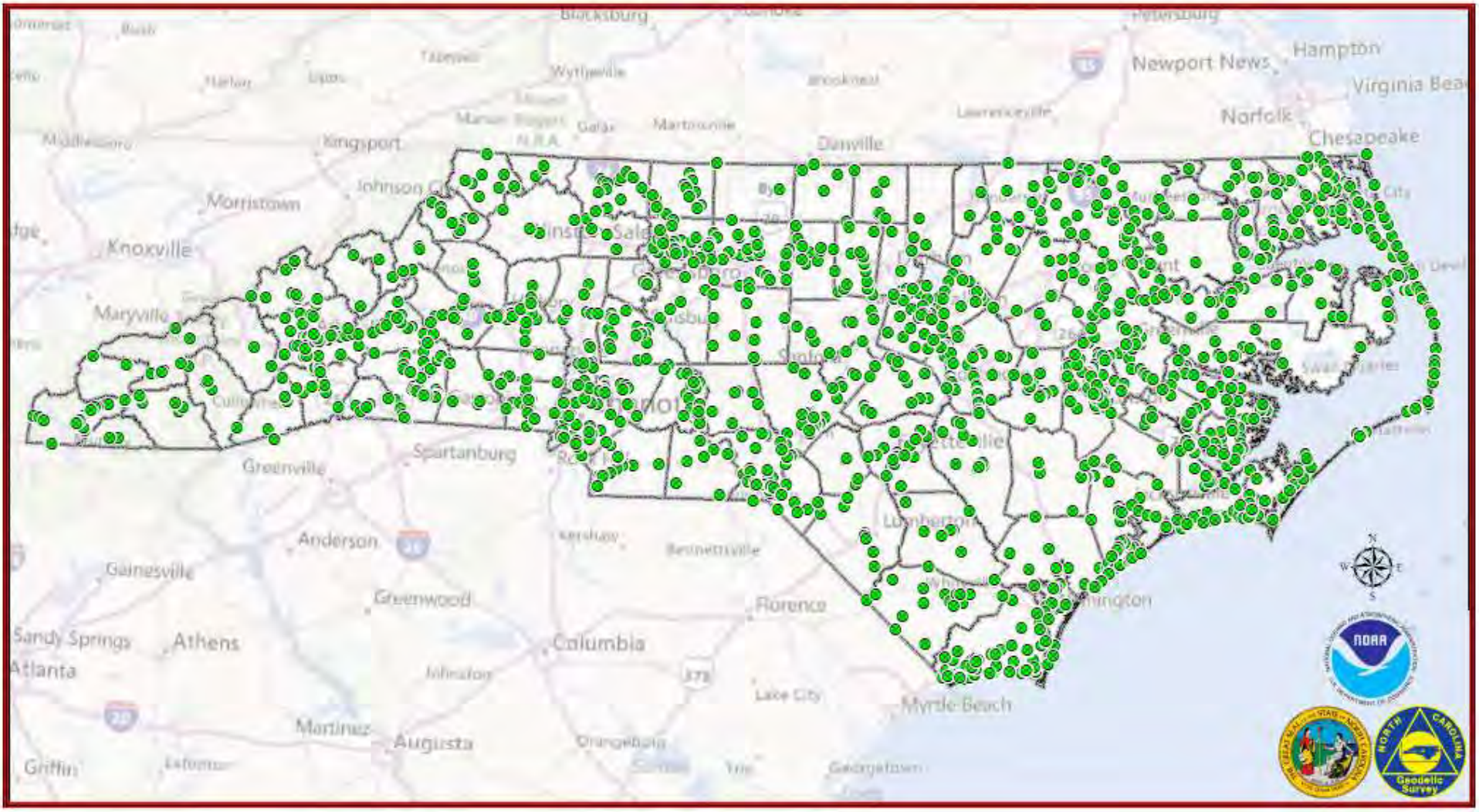
Geoid model history



Geoid model history: GEOID09 in NC



Geoid model history: GEOID12 in NC

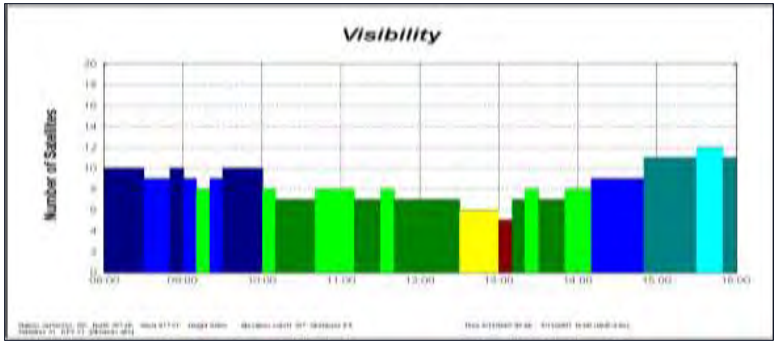


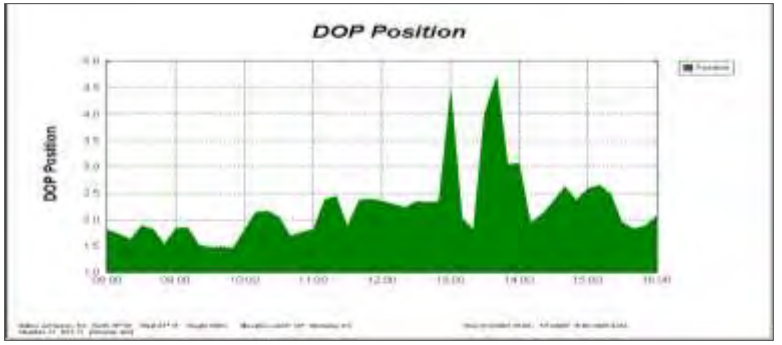
Elevation determination methods

- Leveling
- Global Navigation Satellite System (GNSS)
  - Static (http://www.ngs.noaa.gov/OPUS/)
    - OPUS-S
    - OPUS-RS
  - Real Time Kinematic (RTK)
  - Real Time Network (RTN) (http://rtn2.ncdenr.org/)

GNSS elevation determination methods

- Planning
  - Existing control (horizontal and vertical)
    - Use 1st order or better control (horizontal)
    - Don't mix horizontal control (1st, 2nd , and 3rd)
    - Use marks with Height Modernization or leveled derived NAVD88 heights
  - Mark access
  - Use your planning software
  - Good satellite geometry
  - Collect enough data
  - Space weather



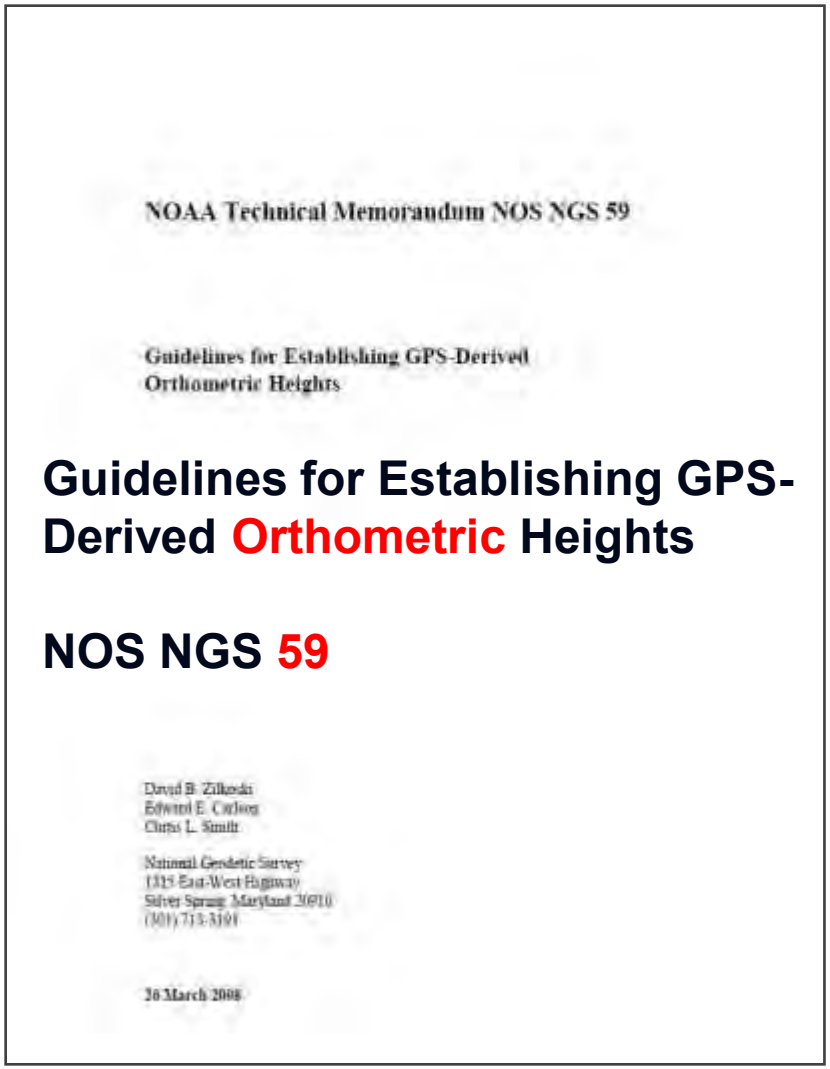


GNSS surveying

- Pick a good open site for control points
- Redundancy
- Good satellite geometry
- Avoid areas that have sources for multipath
- Redundancy
- Avoid antenna height blunders
- Keep equipment adjusted for the highest accuracy
- Check known points before, during and after survey session
- Backup power supply
- The more redundancy the better
- Redundancy

GNSS site selection

Guidelines for establishing GPS-derived heights


NOAA Technical Memorandum NOS NGS 59

Guidelines for Establishing GPS-Derived Orthometric Heights

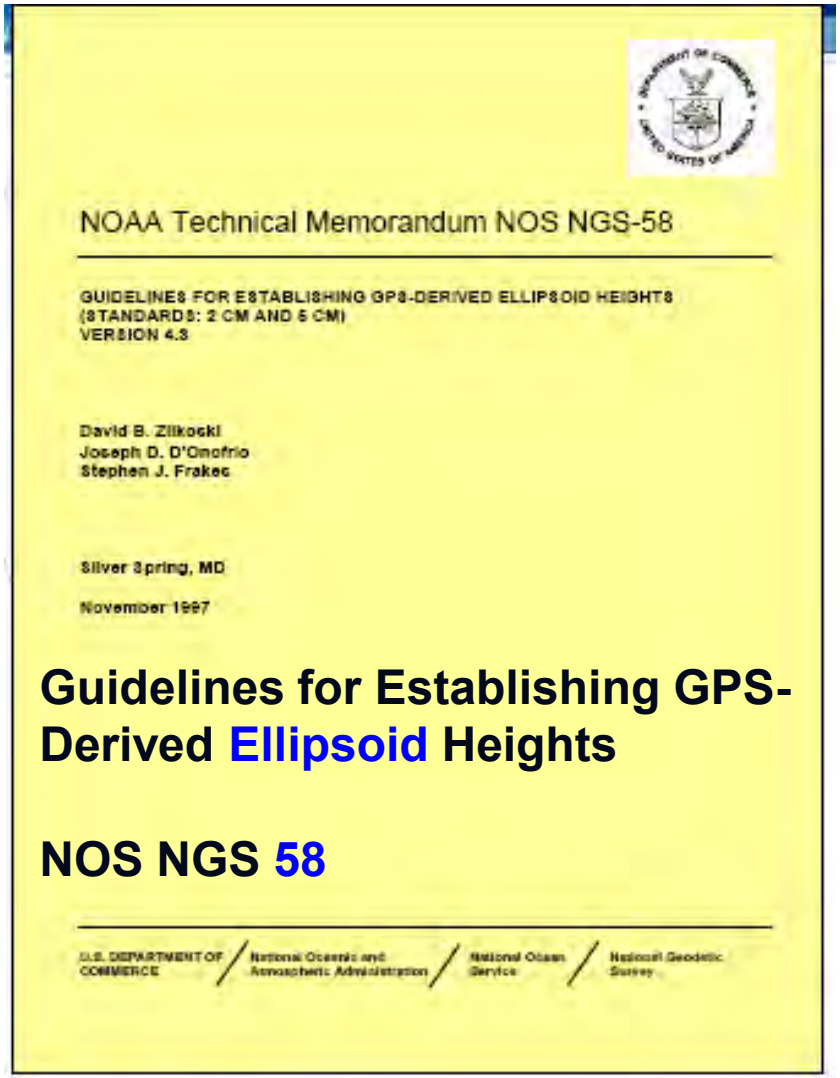
David B. Zilkoski
Edward E. Carlson
Chris L. Smith

National Geodetic Survey
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

30 March 2008

Guidelines for Establishing GPS-Derived Orthometric Heights

NOS NGS 59


NOAA Technical Memorandum NOS NGS-58

GUIDELINES FOR ESTABLISHING GPS-DERIVED ELLIPSOID HEIGHTS
(STANDARDS: 2 CM AND 5 CM)
VERSION 4.3

David B. Zilkoski
Joseph D. D'Onofrio
Stephen J. Frakes

Silver Spring, MD

November 1997

U.S. DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Ocean Service / National Geodetic Survey

Guidelines for Establishing GPS-Derived Ellipsoid Heights

NOS NGS 58

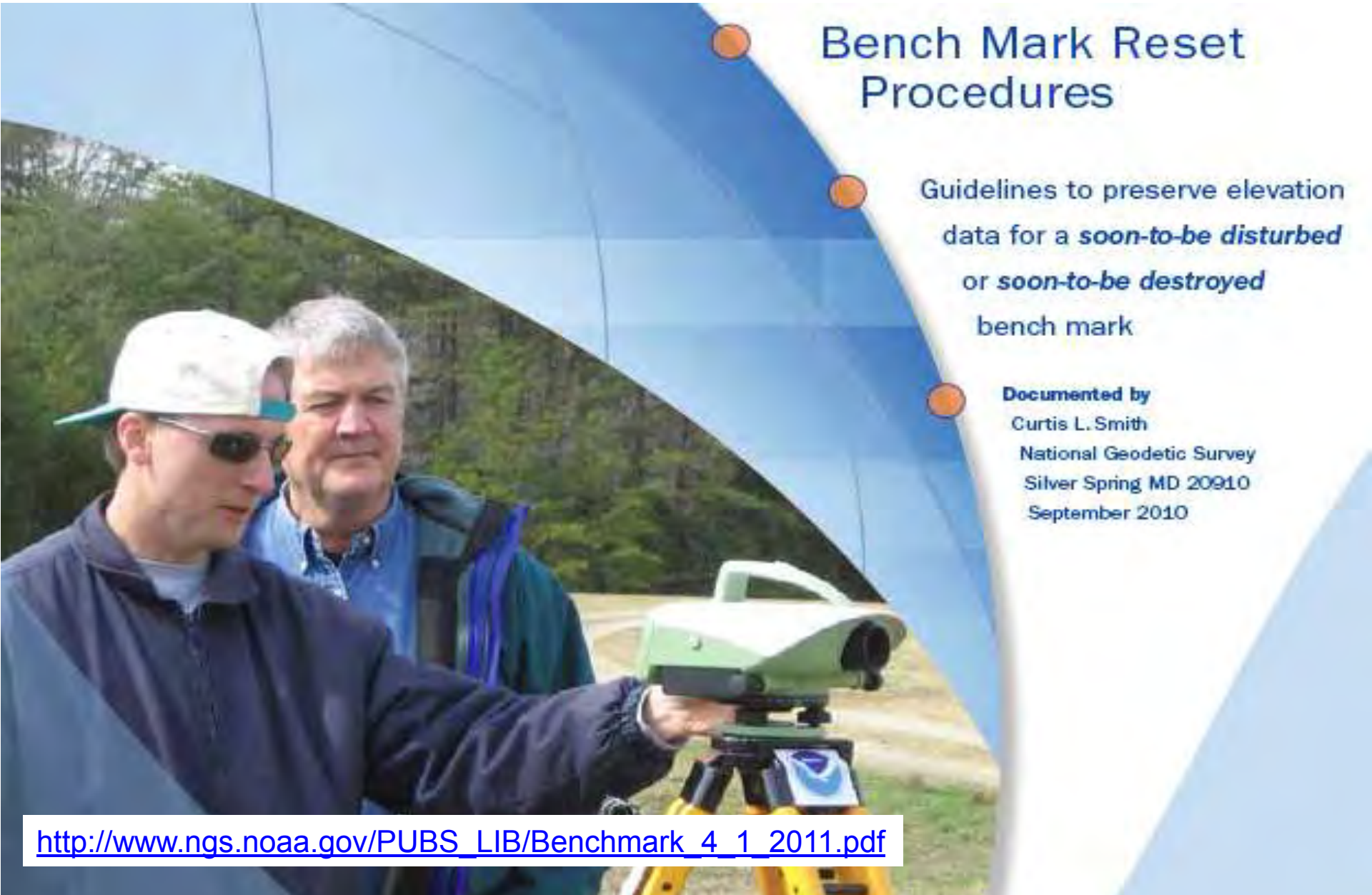
http://www.ngs.noaa.gov/PUBS_LIB/NGS-58.html

http://www.ngs.noaa.gov/PUBS_LIB/NGS592008069FINAL2.pdf

Three basic rules of height determination

- **RULE 1:** Follow NGS' Guidelines for Establishing GPS-Derived Orthometric Heights (Standards: 2cm & 5cm) (http://www.ngs.noaa.gov/PUBS_LIB/NGS592008069FINAL2.pdf)
- **RULE 2:** Use the latest national geoid model, i.e., Geoid12 (http://www.ngs.noaa.gov/GEOID/GEOID12/)
- **RULE 3:** Use the latest national vertical datum, i.e., NAVD 88
- **Rule 4 (NC):** Report positional accuracy and metadata (Board rule .1607) (**http://reports.oah.state.nc.us/ncac/title%2021%20-%20occupational%20licensing%20boards%20and%20commissions/chapter%2056%20-%20engineers%20and%20surveyors/21%20ncac%2056%20.1607.html**)

NGS bench mark reset procedures



http://www.ngs.noaa.gov/PUBS_LIB/Benchmark_4_1_2011.pdf

Highlights of the new Elevation Certificate

- Latest version of the Elevation Certificate (EC) effective March 16, 2009 – March 31, 2012.

- Available for download (in both PDF and MS Word format) from FEMA's website at: http://www.fema.gov/library/viewRecord.do?id=1383

- Elevations certified on or after April 1, 2010, must be submitted on the new form.

- The current form will remain effective until further notice.

Section C (If zone has BFE)

SECTION C - BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☐ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1-A30, AE, AH, A (with BFE), VE, V1-V30, V (with BFE), AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO. Complete Items C2.a-h below according to the building diagram specified in Item A7. Use the same datum as the BFE.

Benchmark Utilized _____ Vertical Datum _____

Conversion/Comments _____

			Check the measurement used.	
a)	Top of bottom floor (including basement, crawlspace, or enclosure floor)	_____.____	☐ feet	☐ meters (Puerto Rico only)
b)	Top of the next higher floor	_____.____	☐ feet	☐ meters (Puerto Rico only)
c)	Bottom of the lowest horizontal structural member (V Zones only)	_____.____	☐ feet	☐ meters (Puerto Rico only)
d)	Attached garage (top of slab)	_____.____	☐ feet	☐ meters (Puerto Rico only)
e)	Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	_____.____	☐ feet	☐ meters (Puerto Rico only)
f)	Lowest adjacent (finished) grade next to building (LAG)	_____.____	☐ feet	☐ meters (Puerto Rico only)
g)	Highest adjacent (finished) grade next to building (HAG)	_____.____	☐ feet	☐ meters (Puerto Rico only)
h)	Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	_____.____	☐ feet	☐ meters (Puerto Rico only)

Section C2

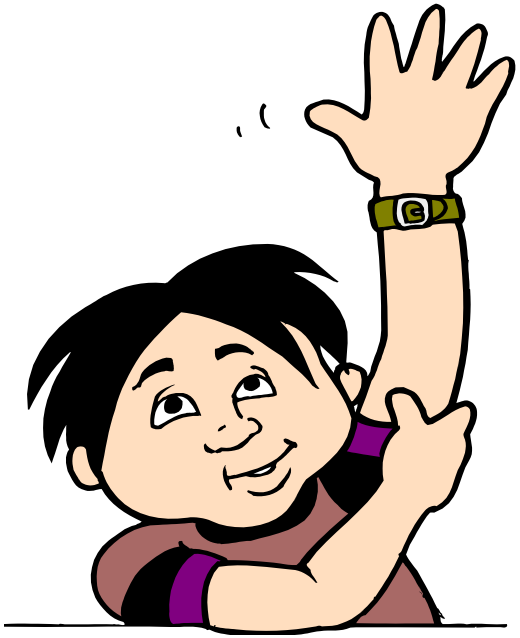
C2. Elevations – Zones A1-A30, AE, AH, A (with BFE), VE, V1-V30, V (with BFE), AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO. Complete Items C2.a-h below according to the building diagram specified in Item A7. Use the same datum as the BFE.

Benchmark Utilized _____ Vertical Datum _____

Conversion/Comments _____

- A field survey is required for Items C2.a-h.
- Enter the Benchmark Utilized. Provide the PID or other unique identifier assigned by the maintainer of the benchmark. For GNSS survey, indicate the benchmark used for the base station, the Continuously Operating Reference Stations (CORS) sites used for an On-line Positioning User Service (OPUS) solution (attach the OPUS report), or the name of the Real Time Network used.
- Note the Vertical Datum. All elevations for the certificate, including the elevations for Items C2.a-h, must use the same datum on which the BFE is based.
- Conversion/Comments. Show the conversion from the field survey datum used if it differs from the datum used for the BFE entered in Item B9 and indicate the conversion formula or software used. Show the datum conversion, if applicable, in this section or in the Comments area of Section D.

Questions?



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